CLAIMS

1. Method of winding a yarn in superposed layers onto a cylindrical support (20) of longitudinal axis (X) and fastened around a spindle (21) driven in a rotational movement, in which the yarn is wound by running over a yarn guide (34) which moves in a traverse motion (M) parallel to the axis (X) of the support and is controlled so as to form a bobbin whose shape has two frustoconical ends (12, 13) called the base cone and the unwind cone respectively, having respective generatrices (L2, L3) which are inclined with respect to the axis (X) at acute angles (α, β) respectively, and a main body (11) which joins the two ends and has a frustoconical shape with a generatrix (L1) and the two end sections (11a, 11b) of which form the two bases (12a, 13a) of the respective two cones (12, 13) and have different diameters, D1 and D2 respectively, **characterized in that** it comprises two rules governing the movement of the yarn guide, a first rule which is used to form part of the base cone (12), the last layer of yarn deposited according to this first rule going as far as the end (13b) of the unwind cone, and a second rule which is used to terminate the said base cone (12) that has been started and, concomitantly, to form the main body (11) and the unwind cone (13), the first layer of yarn deposited according to the second rule being parallel to the last layer deposited according to the first rule.

2. Winding method according to Claim 1, **characterized in that** the first rule governing the movement of the yarn guide consists in establishing traverse motions parallel to the x axis between an initial position (x_0) and a final position (x_z) which correspond, in projection perpendicular to the support (20), to each of the end sections (12b, 13b) of the bobbin respectively, each traverse motion being defined by:

- a starting position (x_j), of which that one for the first movement is the initial position (x_0) and that one for the following movements is a position to the rear of the starting position for the previous movement and always to the front of the final position (x_z), the position for the last movement being dictated by the value of the diameter D1 desired for the base of the base cone (12) to be formed,

- an intermediate position (x_i) for reversal of the yarn guide, which position always lies to the rear of the intermediate position for the previous movement and lies to the front of the final position (x_z), and

- an ending position (x_{j+1}) which constitutes the starting position for the following movement, the last movement according to this first rule not causing a reversal since the last intermediate position which then corresponds to the final position (x_z).

3. Winding method according to Claim 2, **characterized in that** the second rule governing the movement of the yarn guide consists in executing traverse motions parallel to the X axis, between an initial position which constitutes the final position (x_z) of the yarn guide according to the first rule and a terminal position (x_t) which lies between the final position (x_z) according to the first rule, and which is dictated by the value of the diameter D2 desired for the base of the unwind cone (13) to be formed, and the starting position for the last movement according to the first rule, each traverse motion being defined by:

- a starting position (x_k), of which that one for the first movement is the final position (x_z) according to the first rule and that one for the following movements is a position to the rear of the starting position for the previous movement,

- an intermediate position (x_m) for reversal of the yarn guide, of which that one for the first movement is the ending position that the yarn guide ought to have assumed if it had reversed the movement

at the final position (x_z) according to the first rule, and

- an ending position (x_{k+1}) which constitutes the starting position for the following movement,

- the starting and ending positions for a movement always being to the front of those for the previous movement so that each movement is shortened in terms of travel.

4. Method according to Claim 2, **characterized in that** the successive starting positions (x_j) according to the first rule are separated by an equal distance (δ).

5. Method according to Claim 2, **characterized in that** the successive intermediate reversal positions (x_i) according to the first rule are defined by the equation $x_i = x_0 + i\Delta$, where Δ is a positive constant which depends on the slope to be given to the generatrix (L1) of the main body (11), and i varies from 0 to Z, where Z is a non-zero integer.

6. Method according to Claim 3, **characterized in that** the successive starting positions (x_k) according to the second rule are separated by an equal distance (δ').

7. Method according to Claim 3, **characterized in that** the successive intermediate reversal positions (x_m) according to the second rule are spaced apart by the same distance (δ) as that separating the successive starting positions (x_j) according to the first rule.

8. Method according to any one of Claims 1 to 7, **characterized in that** the yarn guide (34) is moved concomitantly with the motion (M) parallel to the axis (X) in a coplanar motion (N) perpendicular to the axis (X) so that the resulting motion is parallel to the generatrix (L1) of the main body (11).

9. Method according to Claim 8, characterized in that the motions parallel (M) and perpendicular (N) to the axis (X) of the yarn guide (34) are produced by an electronic drive device (36).

10. Method according to Claim 8, characterized in that the yarn guide (34) is moved by running along

mechanical guiding means placed parallel to the generatrix (L1) of the main body (11) being formed.

11. Method according to any one of Claims 1 to 10, for which the yarn guide (34) consists of a cam, **characterized in that** the speed of rotation of the cam can be varied.

12. Method according to any one of Claims 1 to 11, **characterized in that** the speed of rotation of the spindle (21) can be varied.

13. Method according to one of Claims 1 to 7, **characterized in that** the speed of movement of the yarn guide parallel to the axis (X) can be varied.

14. Application of the method, as defined by any one of Claims 1 to 13, to the direct winding of a continuous yarn which is obtained by collecting a multiplicity of glass filaments formed from streams of molten glass, emanating from the orifices of a bushing, and which runs along a yarn guide.

15. Frustoconical bobbin obtained by the method according to any one of Claims 1 to 13, **characterized in that** the angle of inclination (α) of the so-called base cone (12) is between 40° and 75°.

16. Frustoconical bobbin obtained by the method according to any one of Claims 1 to 13, **characterized in that** the angle of inclination (β) of the unwind cone (13) is between 30° and 60°.

17. Frustoconical bobbin according to Claim 15 or 16, **characterized in that** the yarn has a waviness (52) so that two coils belonging with two superposed layers respectively intersect at a crossover angle (γ).

18. Frustoconical bobbin according to Claim 17, **characterized in that** the crossover angle (γ) is between 0.5° and 6°.

19. Frustoconical bobbin according to any one of Claims 15 to 18, **characterized in that** it has a length, measured between the two end bases (12b, 13b) of the respective base and unwind cones, which is between 150 mm and 500 mm.